

5.0 Project/Task Description

A water quality study is often undertaken because there is a regulatory or program decision to be made, and new environmental data are required for the decision. "Regulatory and program decisions" are decisions to take an action, such as to

- determine whether a regulation is needed
- develop or revise a standard or regulation
- issue or revise a permit
- find a permittee in or out of compliance
- take enforcement action
- study a problem further
- determine program policy, direction, or priorities
- implement a corrective action program.

In the past, emphasis in the design and implementation of a water quality study has been on the field collection of water and wastewater samples and the analysis of those samples, in the field and in the laboratory, for water quality variables. This emphasis, through rigorous quality assurance and quality control procedures, has ensured that the data collected is the "best data possible." Historically, little emphasis has been made on planning a study to ensure that the data collected will provide adequate information for making a decision.

A water quality monitoring program should be designed to provide information about water quality conditions over time and space and in relation to management goals concerning water quality. Generally, the planning of a data collection effort needs to be emphasized, particularly the following activities: defining monitoring goals and water quality; identifying statistical methodologies to be used and statistical conclusions to be drawn; reviewing and analyzing historical data; and determining where, what, and how frequently to sample. Monitoring programs which neglect precollection planning are often "data rich, information poor." Conclusions regarding water quality may not satisfy management goals and information expectations.

An approach to monitoring system design has been developed by Robert Ward at Colorado State University (Water Quality Monitoring as an Information System, presented to U. S. EPA's National Symposium on Water Quality Assessment, June 1-3, 1998, Annapolis, Maryland). This approach, outlined below, focuses on the need to document why the monitoring is being undertaken, what statistics are to be employed in data analysis, and the need for consistency in all parts of the monitoring system over time.

This approach is:

STEP 1 Define Information Expectations

- determine management and corresponding monitoring goals
- define water quality for monitoring system design purposes
- identify statistical methodology to be used by monitoring system
- state statistical conclusions to be drawn from data and discuss how these conclusions relate to management goals
- describe means of reporting conclusions

STEP 2 Confirm Statistical Design Criteria

- statistically characterize water quality population to be sampled
 - plot concentration and flow vs. time
 - normality testing
 - variance homogeneity testing
 - independence testing
- state that assumptions of chosen statistical methodology are met

STEP 3 Design Monitoring Network

- where to sample (from management/monitoring goals)
- what to measure (from water quality definition and management/monitoring goals)
- how frequently to sample (from needs of selected statistical methodologies)

STEP 4 Develop Operating Plans and Procedures

- sampling routes, equipment and employee training
- field sampling and analysis procedures
- sample preservation and transportation
- laboratory analysis and quality control procedures
- data verification protocols
- data storage and retrieval hardware and software
- data analysis software for chosen statistical methodology

STEP 5 Develop Information Reporting Procedures

- type, format and frequency of reporting
- distribution of reports
- automation of reporting
- evaluation of information relative to expectations defined in Step 1